

What is claimed is:

1. A fuel delivery subsystem for a liquid feed fuel cell system having a fuel cell stack, the fuel delivery subsystem comprising:

- 5 (a) a first fuel reservoir containing substantially pure fuel;
- (b) a second fuel reservoir containing fuel and water, the second fuel reservoir being in communication with the fuel cell stack for delivery of the fuel and
10 water; and
- (c) a fuel transfer medium coupled with both the first fuel reservoir and the second fuel reservoir such that fuel is able to migrate between the first fuel reservoir
15 and the fuel transfer medium and between the fuel transfer medium and the second fuel reservoir;

whereby fuel migrates from the first fuel reservoir to the fuel transfer medium to maintain
20 a first equilibrium concentration of fuel in the fuel transfer medium and whereby fuel migrates from the fuel transfer medium to the second fuel reservoir to maintain a second equilibrium concentration of fuel in the second fuel
25 reservoir.

2. The fuel delivery subsystem of claim 1 wherein the fuel transfer medium is one of a gas, a liquid and a solid.

3. The fuel delivery subsystem of claim 2 wherein the fuel transfer medium is a solid.

4. The fuel delivery subsystem of claim 3 wherein the solid is a membrane separating the first fuel reservoir and the second fuel reservoir.

5. The fuel delivery subsystem of claim 4 wherein the membrane is a cross-linked polymer.

6. The fuel delivery subsystem of claim 4 wherein the membrane is water impermeable.

7. The fuel delivery subsystem of claim 2 wherein the fuel transfer medium is a liquid.

8. The fuel delivery subsystem of claim 7 wherein water is insoluble in the fuel transfer medium.

9. The fuel delivery subsystem of claim 7 further comprising a first membrane separating the first fuel reservoir and the fuel transfer medium and a second membrane separating the fuel transfer medium and the second fuel reservoir, both membranes being permeable to the fuel and impermeable to the fuel transfer medium.

10. The fuel delivery subsystem of claim 9

wherein at least one of the membranes is impermeable to water.

11. The fuel delivery subsystem of claim 2 wherein the fuel transfer medium is a gas.

12. The fuel delivery subsystem of claim 11 wherein the gas is inert.

13. The fuel delivery subsystem of claim 12 wherein the inert gas is nitrogen.

14. The fuel delivery subsystem of claim 11 wherein the first fuel reservoir has a first header space above the fuel and the second fuel reservoir has a second header space above the mixture of fuel and water, the fuel delivery subsystem further comprising:

- (d) a first coupling between the first header space and the fuel and water in the second fuel reservoir;
- 10 (e) a second coupling between the second header space and the fuel in the first fuel reservoir;
- (f) a gas pump for circulating the fuel transfer medium from the first fuel reservoir through the first coupling to
15 the second fuel reservoir and therefrom through the second coupling back to the first fuel reservoir;
- (g) a first temperature control for

20 maintaining the temperature of the first
 fuel reservoir at a first temperature;
 and
 (h) a second temperature control for
 maintaining the temperature of the
25 second fuel reservoir at a second
 temperature greater than the first
 temperature.

15. The fuel delivery subsystem of claim 14
wherein the second temperature is above ambient
temperature.

16. The fuel delivery subsystem of claim 15
wherein the second temperature is between 20°C
and 120°C.

17. The fuel delivery subsystem of claim 14
wherein the first temperature is below ambient
temperature.

18. The fuel delivery subsystem of claim 17
wherein the first temperature is between -20°C
and 20°C.

19. The fuel delivery subsystem of claim 1
wherein the fuel is methanol.

20. A liquid feed fuel cell system
comprising a fuel delivery subsystem of claim 1.

21. The liquid feed fuel cell system of claim 20 wherein the liquid feed fuel cell system is a direct methanol fuel cell system.

22. A method of operating a liquid feed fuel cell system comprising:

- (a) providing a fuel cell stack;
- (b) providing a first fuel reservoir
5 containing substantially pure fuel;
- (c) providing a second fuel reservoir containing fuel and water, the second fuel reservoir being in communication with the fuel cell stack;
- 10 (d) providing a fuel transfer medium coupled with both the first fuel reservoir and the second fuel reservoir such that fuel is able to migrate between the first
15 fuel reservoir and the fuel transfer medium and between the fuel transfer medium and the second fuel reservoir;
- (e) delivering the fuel and water from the second fuel reservoir to the fuel cell stack; and
- 20 (f) operating the fuel cell stack.

23. The method of claim 22 wherein the fuel transfer medium is one of a gas, a liquid and a solid.